PATENT SPECIFICATION
DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Cargo Submarine

I, GORO SATO, a Japanese subject, of No. 336, Inamura, Izusan, Atamishi, Shizuokaken, Japan, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a transport submarine for carrying cargo such as liquid, grain or powder throughout which cargo outside water pressure can be transmitted.

The object of the present invention is to provide a cargo submarine which in comparison with an ordinary type submarine can be built more easily and strongly, and accommodate cargo more efficiently and which can produce a higher performance of undersea transportation so that the weight of the submarine may be reduced by more than 30% of the weight of cargo in an ordinary type submarine, and the building cost reduced by more than 50%—60%.

According to the present invention there is provided a transport submarine for carrying cargo such as liquid, grain or powder, throughout which cargo the outside water pressure can be transmitted, comprising a thin outer non-pressure hull and a comparatively rigid inner pressure hull, which has enough strength to resist the forces due to the outside pressure, extending longitudinally in the said non-pressure hull, the major part of the space between the said inner and outer hulls forming non-pressure cargo holds, characterised in that, in the case of a cargo which may be allowed to come in contact with water, outside sea water is directly admitted into the non-pressure holds to balance the outside and inside pressures, whilst in the case of a cargo which must be kept separate from water, a device to transmit outside water pressures to the inside of the holds balances the outside and inside pressures.

The invention is illustrated by way of example in the accompanying drawings in which:

Figure 1 is a longitudinal sectional view of a transport submarine according to the present invention.

Figure 2 is a cross sectional view taken on line II—II of Figure 1.

Figure 3 and Figure 4 are fragmentary sectional views of pressure responsive devices on an enlarged scale.

Referring now in detail to Figure 1, numeral 1 indicates a non-pressure thin outer hull of a submarine. In said hull 1 is provided a comparatively rigid inner pressure hull 2 which has enough strength to resist the force due to the outside pressure forming an engine room 3 therein. The space surrounding the midship section of the pressure hull 2 and inwardly of the non-pressure hull 1 is for a main buoyancy tank 4 which provides the ability to surface and has air and outside seawater connections. As shown in Figure 2, both sides of the engine room 3 are attached transverse balance tanks 6 partitioned by bulkheads 5. The tops of the tanks 6 are connected by an air pipe 7 and the bottom by a water pipe 8 through a pump (not shown). Water in one of the tanks may be moved to the other to correct the transverse inclination of the submarine. Under a floor board 9 is formed a buoyancy control tank 10, into which sea water is introduced for adjustment of the buoyancy of the vessel as a whole A control room 12 is formed inside a rigid pressure hull 13 which is fixed to the fore bulkhead 11 of the engine room 3. Under the floor board 14 of the control room 12 is situated an hold 15, the volume of which is about 20% of that of the non-pressure hold 16. Rigid pressure hull end sections 19 affixed to the fore bulkhead 17 of the control room 12 and to the aft bulkhead of the engine room 3 respectively are for pressure holds 18 which are used to adjust buoyancy. The spaces outside of the pressure hull

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sections 19 in the non-pressure hull 1 are for non-pressure holds 20 which are partitioned by bulkheads 21 connecting the pressure hull sections 19 to the non-pressure hull 1. This provides a strong structure for the submarine like the skeleton of a fish. As shown in Figure 1 the pressure holds 18 in the pressure hull sections 19 are also partitioned by bulkheads 22 at the positions corresponding to those of the bulkheads 21 mentioned above. The foremost portion of the fore pressure hull section 19 is partitioned to comprise a fore trim tank 24 by means of a bulkhead 23. Numeral 25 designates a sonar dome. Numerals 26 and 35 designate respectively devices transmitting outside pressure and admitting outside water into the non-pressure holds 20.

In the case of a submarine tanker, the pressure holds 15, 18 may be filled with oil during transportation, but in a return voyage, although the non-pressure holds 16, 20 are filled with water, the pressure holds 15, 18 are vacant so that the buoyancy of the vessel as a whole may be always kept almost constant, as the volume of the pressure holds including bow and stern side holds is about 20% of that of the non-pressure holds.

In the case of cargo material which will mix with or dissolve in water, as shown in Figure 3, the non-pressure hull 1 has a hole 27 around which a cylinder 28 of the device 26 is attached and said cylinder has a hole 29 at the lower end. The cylinder 28 has a piston 30 therein and a spring 31 positioned under the piston for normally urging the piston upwardly. This piston is connected to the non-pressure hull 1 by means of bellows 32 and prevents the outside water from entering the hold 20 but the pressure of said water, which pushes down the piston 30, downwardly forces air through the hole 29 in the cylinder 28, into the non-pressure hold 20. Thus the pressure in the non-pressure hold 20 and the outside pressure balance and consequently the non-pressure hull 1 can be made thinner than would otherwise be the case. The rear of the aft water pressure hull section 19 is partitioned to provide an aft trim tank 34 by means of a bulkhead 33. The fore trim tank 24 removes the trimming water to and from the aft trim tank 34 by conventional means so as to adjust the trim of the vessel. In the case of cargo material for example oil, which will neither mix with nor dissolve in water, as shown in Figure 4, the non-pressure hull 1 has a hole 36 through which sea water comes into the non-pressure hold 20 to balance the outside and inside pressures. For example water 37 and oil 38 in the non-pressure hold 20 keep separate as shown. The hole 36 can be closed by means of a valve 39 of the device 35 when necessary. The valve 39 is provided with a piston 40 slidable in a casing 42. A spring 43 tends to push the piston 40 downwardly and normally keeps the valve 39 open. When pressure oil is sent through an oil pressure pipe 41 the valve 39 is forced by means of the piston 40 to close the hole 36. Numeral 44 designates a strut. When the non-pressure hold 20 is filled with liquid cargo, even though the device prevents sea water from coming into the non-pressure hold 20, the pressure of the sea water is transmitted to the liquid cargo in the hold 20 through the plating of the hull 1. Therefore the non-pressure hull 1 need not be so thick as the hull of an ordinary type submarine.

Thus it will be apparent that the cargo such as, for example, oil may be carried in the holds 20 and that varying pressures upon the outer hull 1 are compensated for by the devices 26 and 35, as above described. The buoyancy is maintained by the tanks 4 and 10 and trim by the tanks 24 and 34 as heretofore set forth. Ballast water may be transferred between the tanks 6 in a conventional manner.

WHAT I CLAIM IS:—

1. A transport submarine for carrying cargo such as liquid, grain or powder, throughout which cargo the outside water pressure can be transmitted, comprising a thin outer non-pressure hull and a comparatively rigid inner pressure hull, which has enought strength to resist the forces due to the outside pressure, extending longitudinally in the said non-pressure hull, the major part of the space between the said inner and outer hulls forming non-pressure cargo holds, characterised in that, in the case of a cargo which may be allowed to come in contact with water, outside sea water is directly admitted into the non-pressure holds to balance the outside and inside pressures, whilst in the case of a cargo which must be kept separate from water, a device to transmit outside water pressure to the inside of the holds balances the outside and inside pressures.

2. A transport submarine as claimed in Claim 1, in which the inner pressure hull, which extends longitudinally in the non-pressure hull and is rigidly constructed so as to resist the bending, torsional and breaking forces to which the submarine is subjected, has midship sections of larger diameters than the end sections which are tapered.

3. A transport submarine as claimed in Claim 2, in which the midship section of the pressure hull having sections of the largest diameter forms an engine room and a space in front of the said engine room forms a control room, and the end sections of the pressure hull form buoyancy adjusting tanks which are provided respectively at the back of the engine room and in front of the control room, and the spaces between the non-pressure hull and the outside of the buoyancy adjusting tanks are divided by bulkheads at intervals and at positions corresponding to the positions of bulkheads in the pressure hull.

4. A transport submarine as claimed in claim 3, in which the space between the outside of the engine room and non-pressure hull forms a main buoyancy tank, and the space under the floor of the engine room forming a buoyancy control tank of the submarine.

5. A transport submarine as claimed in Claim 4, in which the outside sea water is admitted into the main buoyancy tank in order to surface or dive the submarine by replacing water with air or air with water in the said tank.

6. A transport submarine as claimed in Claim 4, in which the buoyancy control tank provided under the engine room is included in the pressure hull, adjusting to a minute degree the buoyancy of the submarine by replacing water with air or air with water in the said tank.

7. A transport submarine as claimed in Claim 3, in which the spaces at the sides of the engine room form balance tanks, the top of which are connected by an air pipe and the bottoms by a water pipe through a pump so that water in one of the tanks can be removed to the other tank to correct the transverse inclination of the submarine.

8. A transport submarine as claimed in Claim 3, in which the space between the outside of the control room and the non-pressure hull form non-pressure holds.

9. A transport submarine as claimed in Claim 3, in which the space within the pressure hull under the control room forms a buoyancy adjusting tank, which controls the variation of buoyancy caused by changes of cargoes in the non-pressure hull surrounding the control room in order to keep the buoyancy constant.

10. A transport submarine as claimed in any preceding claim, in which the bow end and stern end of the pressure hull are partitioned to form respectively fore and aft trimming tanks which control the fore and aft trim of the submarine.

11. A transport submarine constructed and arranged substantially as described herein with reference to the accompanying drawings.

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1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

Fig. 1

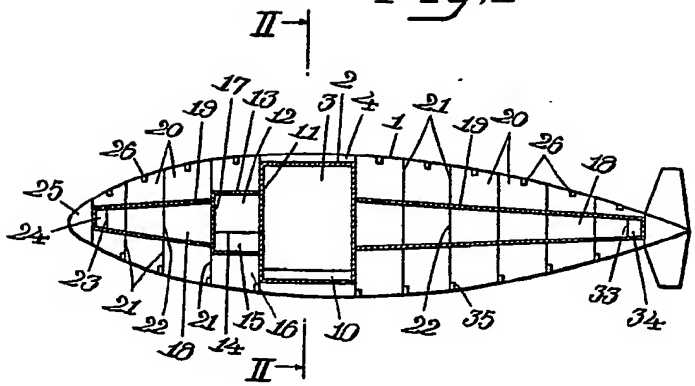

Fig. 2

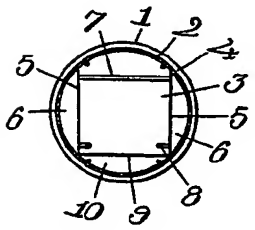

Fig. 3

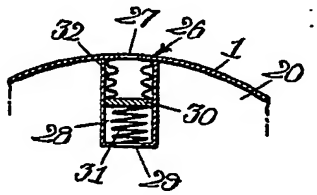

Fig. 4